EXHIBIT A

P10455

INTEL INVENTION DISCLOSURE

ATTORNEY-CLIENT PRIVILEGED COMMUNICATION

DATE: [redacted] Software/Internet/IAL/ASL [redacted]

It is important to provide accurate and detailed information on this form. The information will be used to evaluate your invention for possible filing as a patent application. When completed and signed, please return this form to the **Legal Department at JF3-147**. If you have any questions, please call **264-0444.**

1. Inventor: Sharma (Last Name) Sangita (First Name) R (Middle Initial)

Phone [redacted] M/S: [redacted] Fax # [redacted]

Citizenship: [redacted] WWID: [redacted] Contractor: [redacted]

Inventor E-Mail Address: [redacted]

Home Address: [redacted]

City [redacted] State [redacted] Zip [redacted] Country [redacted]

*Corporate Level Group (e.g. IABG, NCG, CEG) [redacted] Division [redacted] Subdivision [redacted]

Supervisor* [redacted] WWID [redacted] Phone [redacted] M/S: [redacted]

Inventor: Larson (Last Name) Jim (First Name) A (Middle Initial)

Phone [redacted] M/S: [redacted] Fax [redacted]

Citizenship: [redacted] WWID: [redacted] Contractor: [redacted]

Inventor E-Mail Address: [redacted]

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*Corporate Level Group (e.g. IABG, NCG, CEG) [redacted] Division [redacted] Subdivision [redacted]

Supervisor* [redacted] WWID [redacted] Phone [redacted] M/S: [redacted]

Inventor: Chartier (Last Name) Mike (First Name) S (Middle Initial)

Phone [redacted] M/S: [redacted] Fax # [redacted]

Citizenship: [redacted] WWID: [redacted] Contractor: [redacted]

Inventor E-Mail Address: [redacted]

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City [redacted] State [redacted] Zip [redacted] Country [redacted]

*Corporate Level Group (e.g. IABG, NCG, CEG) [redacted] Division [redacted] Subdivision

Supervisor* [redacted] WWID [redacted] Phone [redacted] M/S [redacted]

RECEIVED

[redacted]

PATENT DATABASE GROUP
INTEL LEGAL TEAM

2. Title of Invention: **Server-Based Adaptation of Acoustic Models for Client-Based Speech Systems to Improve Recognition Accuracy**

3. What technology/product/process (code name) does it relate to (be specific if you can):
Speech recognition application

4. Include several key words to describe the technology area of the invention in addition to # 3 above: client-server speech recognition, adaptation, acoustic models, recognition accuarcy

5. Stage of development (i.e. % complete, simulations done, test chips if any, etc.): [redacted]

6. (a) Has a description of your invention been, or will it shortly be, published outside Intel:

NO: [redacted] YES: [redacted] If YES, was the manuscript submitted for pre-publication approval? _____

IDENTIFY THE PUBLICATION AND THE DATE PUBLISHED: _____

(b) Has your invention been used/sold or planned to be used/sold by Intel or others?

NO: [redacted] YES: [redacted] DATE WAS OR WILL BE SOLD: _____

(c) Does this invention relate to technology that is or will be covered by a SIG (special interest group)/standard/ or specification?

NO: [redacted] YES: [redacted] Name of SIG/Standard/Specification: _____

(d) If the invention is embodied in a semiconductor device, actual or anticipated date of tapeout [redacted]

(e) If the invention is software, actual or anticipated date of any beta tests outside Intel [redacted]

7. Was the invention conceived or constructed in collaboration with anyone other than an Intel blue badge employee or in performance of a project involving entities other than Intel, e.g. government, other companies, universities or consortia? NO: [redacted] YES: [redacted] Name of individual or entity: _____

8. Is this invention related to any other invention disclosure that you have recently submitted? If so, please give the title and inventors: [redacted]

1. Introduction

Speech is emerging as a natural modality for human-computer interaction, especially since the notion of computing is shifting from the standard desktop PC's to small mobile hand-held devices and wearable computers. Speech recognition algorithms use statistical models for performing pattern recognition. As with any statistical technique, a large amount of data is required to compute reliable and robust acoustic models. **This invention describes a method for adapting the acoustic models in small client-based speech systems to continually improve their performance.**

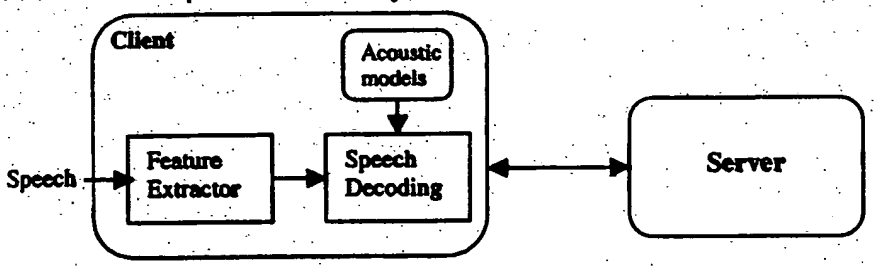
2. Advantage(s) of your invention over what is done now.

Speech signal has several variabilities such as speaker variability due to gender, age, accent, emotions and health factors, environment variability due to microphones, transmission channel, background noise, reverberation, etc. These make the parameters of the statistical models for speech recognition difficult to estimate. One approach to deal with these variabilities is adaptation of the statistical acoustic models as more data becomes available due to usage of the system. Such an adaptation is known to significantly improve the recognition accuracy of the speech system. However, small computing devices are inherently limited in their processing power and memory availability, making the use of adaptation or any re-training difficult. As a result, adaptation on small clients is most often not performed. In this case, the speech recognition system has to rely on the original acoustic models that are not often well matched with the usage conditions resulting in reduced recognition accuracy.

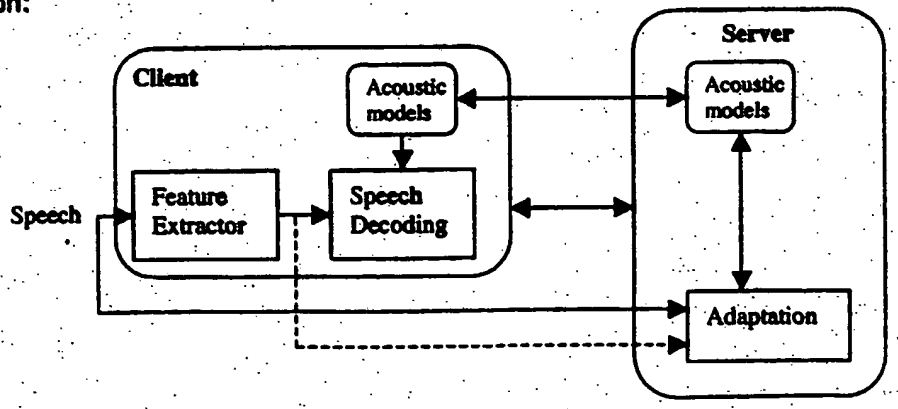
This invention overcomes this limitation in small client-based speech recognition systems. The proposed method uses a server to carry out off-line adaptation of the acoustic models. The adapted models are then downloaded to the client. This method reduces the computation overhead of the client while at the same time it enhances the user experience by continually improving the system performance with more usage. Also, storage space requirement on the client is minimized because different acoustical models can be downloaded as the client usage is changed due to different user, different noise environment, etc.

3. Detailed description of the invention

Current small client speech-enabled systems:



Invention:



The block diagram illustrates the invention and contrasts it with the current system. The invention consists of the following stages -

- The server stores a copy of the acoustic models being used by the client-based speech recognition system.
- Data in the form of raw speech data or speech features computed during the usage of the speech system on the client can be transmitted to the server whenever there is network connection between the client and the server. This is true for a client that accesses the Internet for updating its information database. Data can also be collected by a recognition system that is running independently on the server.
- These client acoustic models are adapted by using this data. Algorithms such as maximum-likelihood linear regression or parallel model combination can be used for adapting the models.
- The updated models are then downloaded to the client.

Regular updating of the acoustic models is known to improve speech recognition accuracy. This is especially true in the case of small-client based speech systems since such systems will typically be single-user systems and adaptation of the models with the user's speech will improve the recognition accuracy for the user. This invention makes such an adaptation feasible.

1. Value of your invention to Intel (how will it be used?).

This invention can be incorporated in any speech recognition application where the recognition algorithm is running on a small client with limited computing capabilities and where a connection, either continuous or intermittent, to the server is expected. Use of this invention will result in significant improvement in recognition accuracy and hence better user experience. [redacted] and exploring the use of speech recognition on these devices can use this invention to differentiate their product from their competitors and enhance user experience.

2. Explain how your invention is novel. If the technology itself is not new, explain what makes it different.

Adaptation of acoustic models to improve recognition accuracy is not a novel idea. However, this invention's specific approach to use it for small client-end acoustic models is new.

3. Identify the closest or most pertinent prior art that you are aware of.

None identified at present time.

4. Who is likely to want to use this invention or infringe the patent if one is obtained and how would infringement be detected?

Companies that are developing speech applications on small form-factor clients such as Conversa and tablet manufacturers can use this invention. Presence and examination of the acoustic models stored on the server can be used to detect the use of this invention.

DATE: [redacted] SUPERVISOR: [redacted]

BY THIS SIGNING, I (SUPERVISOR) ACKNOWLEDGE THAT I HAVE READ AND UNDERSTAND THIS DISCLOSURE, AND RECOMMEND THAT THE HONORARIUM BE PAID

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application. No.	:	09/817,830	Confirmation No. 7805
Applicant	:	Sangita R. Sharma	
Filed	:	3/26/2001	
TC/A.U.	:	2655	
Examiner	:	Huyen X Vo	
Docket No.	:	042390.P10455	
Customer No.	:	8791	

Commissioner for Patents
PO Box 1450
Alexandria VA 22313-1450

DECLARATION UNDER 37 C.F.R. § 1.131

Dear Sir:

We, Sangita R. Shama, Jim A. Larson, and Mike S. Chartier, hereby declare that:

1. We are joint inventors of the subject matter claimed in the above-identified patent application, which is assigned to Intel Corporation.

2. This declaration is to establish conception of the invention in the above-identified application in the United States, at a date prior to January 8, 2001, the filing date of the U.S. Patent Publication No. 2002-0091527, which was cited by the Examiner.

3. We understand that the invention relates to the following:

A. An apparatus comprising:

a server to couple to a client device having speech recognition functionality; and

an acoustic model adaptor locatable at the server to adapt an acoustic model for the client device.

B. A method comprising:

storing a copy of an acoustic model for a client device having speech recognition functionality;

receiving speech data from the client device; and

adapting the acoustic model for the client device.

C. A system comprising:

a server to couple to a client device having speech recognition functionality, the client device and server being coupled through a network; and

an acoustic model adaptor locatable at the server to adapt an acoustic model for the client device.

D. A machine-readable medium having stored thereon instructions, which when executed by a machine, causes the machine to perform the following:

storing a copy of an acoustic model for a client device having speech recognition functionality;

receiving speech data from the client device; and

adapting the acoustic model for the client device.

4. Prior to January 8, 2001, we completed an Intel Invention Disclosure (Exhibit A) describing the invention and submitted the invention disclosure to the legal department of Intel Corporation.

5. After receipt and review of the Intel Invention Disclosure, the legal department of Intel Corporation decided to proceed and request Blakely, Sokoloff, Taylor & Zafman LLP to prepare and file a patent application on the subject matter set forth in Exhibit A.

6. Thereafter, the above-identified patent application was prepared with due diligence and filed on March 26, 2001.

Date: June 03, 2004

Sangita R. Sharma

Date: _____

Jim A. Larson

Date: _____

Mike S. Chartier

adapting the acoustic model for the client device.

C. A system comprising:

a server to couple to a client device having speech recognition functionality, the client device and server being coupled through a network; and

an acoustic model adaptor locatable at the server to adapt an acoustic model for the client device.

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storing a copy of an acoustic model for a client device having speech recognition functionality;

receiving speech data from the client device; and

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6. Thereafter, the above-identified patent application was prepared with due diligence and filed on March 26, 2001.

Date: _____ _____
Sangita R. Sharma

Date: June 3, 2004 Jim A Larson
Jim A. Larson

Date: _____ _____
Mike S. Chartier

adapting the acoustic model for the client device.

C. A system comprising:

a server to couple to a client device having speech recognition functionality, the client device and server being coupled through a network; and

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adapting the acoustic model for the client device.

4. Prior to January 8, 2001, we completed an Intel Invention Disclosure (Exhibit A) describing the invention and submitted the invention disclosure to the legal department of Intel Corporation.

5. After receipt and review of the Intel Invention Disclosure, the legal department of Intel Corporation decided to proceed and request Blakely, Sokoloff, Taylor & Zafman LLP to prepare and file a patent application on the subject matter set forth in Exhibit A.

6. Thereafter, the above-identified patent application was prepared with due diligence and filed on March 26, 2001.

Date: _____ _____
Sangita R. Sharma

Date: _____ _____
Jim A. Larson

Date: 6/3/04 _____
Mike S. Chartier